Coordinated Effects in the 2010 Horizontal Merger Guidelines*

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Abstract

Recent research has highlighted the quantitative contribution to merger analysis from extending unilateral effects models to understand the payoffs to future potential coordinated effects. Some of the emphasis of this research appears to have made its way into the 2010 Horizontal Merger Guidelines. In this paper, we demonstrate the quantification of coordinated effects in an oligopoly and procurement model, and we show that screens based on upward pricing pressure are not adequate in mergers where coordinated effects are a potential concern.

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"The Agencies examine whether a merger is likely to change the manner in which market participants interact, inducing substantially more coordinated interaction."[1]

1 Introduction

Incentives matter, and the incentive for firms in an industry to engage in coordinated interaction is an increasing function of their payoffs from doing so. Instead of focusing on these payoffs to coordinated interaction, the 1997 Guidelines exclusively addressed the *probability* of coordinated interaction, which is not directly amenable to quantification. In contrast, the 2010 Guidelines recognize that the *payoffs* from coordinated interaction are relevant: "The Agencies regard coordinated interaction as more likely, the more the participants stand to gain from successful coordination."[2] Furthermore, the payoffs from coordinated interaction can be quantified, with large payoffs to such conduct implying that the conduct is likely.

In recent work, two of us, with coauthors, have proposed a straightforward way of quantifying the payoff to coordinated interaction (see Kovacic et al., 2006, 2009). The quantification of the payoff to coordinated interaction starts with a unilateral effects model, which could be a model of differentiated product price competition, a procurement or auction model, or whatever is appropriate for the product/industry/market under consideration. Taking as given that such a model has been created for the analysis of post-merger unilateral effects, the recent aforementioned research has advocated that the unilateral effects modeling tool be extended to look at coordinated effects. Specifically, it recommends the use of the unilateral effects model to quantify the impact on firm profits as a consequence of incremental mergers beyond the proposed merger, using the profits from these incremental mergers as a measure of the possible profits available from coordination. The higher are the profits from coordination, the greater will be the firms' incentives to overcome whatever impediments to coordination they face. This quantification of the possible payoff from coordination does not replace anything that the FTC or DoJ has previously done to analyze coordinated effects, but is rather an augmentation.

The 2010 Guidelines adopt upward pricing pressure (UPP) as one method for analyzing potential unilateral effects from horizontal mergers involving differentiated products. The

[1] Horizontal Merger Guidlines, Federal Trade Commission and Department of Justice, Issued August 19, 2010. page 25, http://www.ftc.gov/os/2010/08/100819hmg.pdf, accessed December 21, 2010.

[2] Horizontal Merger Guidlines, Federal Trade Commission and Department of Justice, Issued August 19, 2010. page 26, http://www.ftc.gov/os/2010/08/100819hmg.pdf, accessed December 21, 2010.

current chief economist of the FTC, Professor Joe Farrell, and the current chief economist of the DoJ, Professor Carl Shapiro, have coauthored work that advocates the use of upward pricing pressure for unilateral effects analysis. Upward pricing pressure is a simple concept that captures some essential features of bilateral firm interaction in a market with differentiated products. A merger may result in production efficiencies that will naturally put downward pressure on price. However, a merged entity will also evaluate the internalized effect on profits for one product from changing the price of another product. If a price increase for one product substantially increases profits for a second, and even net of efficiency gains the merged entity finds it worthwhile to increase prices above pre-merger levels, then Farrell and Shapiro advocate that the merger should be scrutinized. As described in Langenfeld and Wrobel (2010, p.22), "UPP is an all-or-nothing test: It does not attempt to predict the level of price increase that the merged firm would actually be able to sustain." Proponents of UPP have offered it primarily as a screening tool to identify mergers that warrant closer scrutiny.[3]

In this paper, we show that UPP is not sufficient as a screen when coordinated effects are a potential concern associated with a proposed merger. We provide a theoretical model and real-world application in which there is no upward pricing pressure associated with a merger, even without countervailing efficiency effects, but in which the merger creates strong incentives for coordinated interaction among firms.

In its discussion of coordinated effects analysis, the 2010 Guidelines state, "Buyer characteristics and the nature of the procurement process can affect coordination." (2010 Guidelines, p.27) Thus, we continue our discussion by illustrating how one can use a procurement model to quantify the extent to which a merger increases incentives for coordination, using the recent merger of BASF and Ciba as a foundation for this analysis. Recent innovations in numerical methods and software for analyzing procurement models allows us to examine the profits to bidding firms associated with mergers and various coordinated interaction. As we show, in addition to basic coordinated effects, the methods also allow the consideration of post-merger efficiencies, the role of fringe firms and mavericks, and the effects of divestiture.

In Section 2, we review proposed measures of UPP and examine the application of UPP measures to a standard oligopoly model and to an application based on the vitamins industry. In Section 3, we provide techniques that can be used to analyze coordinated effects when buyers use 'competitive' procurements for price discovery and illustrate their use with an application based on the recent BASF-Ciba merger. In Section 4, we offer concluding remarks.

[3] See Farrell and Shapiro (2010a).

2 Coordinated effects in an oligopoly model

We begin with a brief introduction to proposed measures of UPP. In Section 2.2, we analyze the performance of UPP measures in a standard differentiated products oligopoly model. In Section 2.3, we use an example involving multi-product firms to illustrate how the UPP screen might fail to identify a serious coordinated effects concern if it were used as a screen to identify mergers requiring further analysis. In Section 2.4, we provide an application to the analysis of potential coordinated effects from hypothetical mergers among vitamins manufacturers.

2.1 Upward pricing pressure

The 2010 Guidelines state:

> "Adverse unilateral price effects can arise when the merger gives the merged entity an incentive to raise the price of a product previously sold by one merging firm and thereby divert sales to products previously sold by the other merging firm, boosting the profits on the latter products. Taking as given other prices and product offerings, that boost to profits is equal to the value to the merged firm of the sales diverted to those products. The value of sales diverted to a product is equal to the number of units diverted to that product multiplied by the margin between price and incremental cost on that product. In some cases, where sufficient information is available, the Agencies assess the value of diverted sales, which can serve as an indicator of the upward pricing pressure on the first product resulting from the merger. ... If the value of diverted sales is proportionately small, significant unilateral price effects are unlikely." (2010 Guidelines, p.21)

The 2010 Guidelines clarify that, "For this purpose, the value of diverted sales is measured in proportion to the lost revenues attributable to the reduction in unit sales resulting from the price increase. Those lost revenues equal the reduction in the number of units sold of that product multiplied by that product's price." (2010 Guidelines, footnote 11)

To provide an implementation of UPP, Farrell and Shapiro (2010b) consider a merger between Products 1 and 2 and measure the upward pricing pressure on Product 1 as a result of the merger as

$$UPP_1 = D_{12}(p_2 - c_2),$$

where D_{12} is the fraction of sales gained by Product 1 when P_1 falls, that come at the expense of sales of Product 2, p_2 is the pre-merger price of Product 2, and c_2 is the pre-merger marginal cost of Product 2. Taking into account the effect of merger efficiencies, the *net* upward pricing pressure is

$$NUPP_1 = D_{12}(p_2 - c_2) - e_1 c_1,$$

where e_1 is an "efficiency credit" applied to Product 1, meaning that the merger is assumed to reduce the marginal cost of Product 1 by $e_1 c_1$.

2.2 UPP in a differentiated products oligopoly

To further explore the UPP measure defined above, we place it in the context of a standard model of a differentiated products oligopoly.

Consider a model in which $n \geq 2$ firms compete in a differentiated products oligopoly. Assume firms engage in price competition, with each firm choosing a price for its product.

We adopt a symmetric version of the model presented in Singh and Vives (1984), although we extend the model to allow more than two firms. We work with inverse demand functions

$$p_i = a - bq_i - sb \sum_{j \neq i} q_j,$$

where $s \in (0, 1)$. As one can see from these demand functions, the market price for firm i's product is decreasing in its own quantity. This is a standard downward sloping demand curve. The market price for firm i's product is also decreasing in the quantities produced by firm i's rivals; however, because s is less than one, the impact on firm i's price of an increase in the rivals' total quantity is less than the impact of an equal increase in firm i's own quantity.

We assume firm i has constant marginal cost $c_i < a$ and zero fixed costs. Thus, firm i's payoff is equal to its price minus its marginal cost, times the quantity it produces: $(p_i - c_i)q_i$.

We can write the demand functions as

$$q_i = \frac{a(1-s) - p_i - s(n-2)p_i + s\sum_{j \neq i} p_j}{b(1-s)(1+(n-1)s)}.$$

The diversion ratio from product 1 to product 2 is

$$D_{12} \equiv -\frac{\frac{\partial q_2}{\partial p_1}}{\frac{\partial q_1}{\partial p_1}} = \frac{s}{1+s(n-2)}. \tag{1}$$

If the products are independent, then $s = 0$ and the diversion ratio is zero. In the case of independent products, a change in product 1's price does not allow it to captures any sales from product 2.

If the products are perfect substitutes, then $s = 1$ and the diversion ratio is $\frac{1}{n-1}$, which is decreasing in the number of firms. The effect on the diversion ratio of the number of firms can be interpreted as saying that when there are more (symmetric) firms in the industry, the diversion ratio will be smaller because a smaller share of the incremental sales captured through a decrease in price is diverted from any particular rival firm.

Using (1), we see that with only two firms ($n = 2$), the diversion ratio is simply s, the substitutability parameter.

As a simple example, if $n = 3$ then $D_{12} = \frac{s}{1+s}$, which says that if the products are perfect substitutes ($s = 1$), then the diversion ratio is one-half. In other words, when firm 1 reduces the price of product 1, it captures all sales from firms 2 and 3, and so one-half of the diverted sales are from firm 2.

To evaluate the value of the diverted sales, the upward pricing pressure model uses pre-merger prices and marginal costs. If we assume competitive behavior prior to the merger, our model of price competition implies that p_i would be given by:

$$p_i^* = \frac{a(1-s)(2+(2n-3)s) + (1+(n-2)s)((2+s(n-2))\,c_i + s\sum_{j \neq i} c_j)}{(2+(n-3)s)(2+(2n-3)s)}.$$

Using the definition of upward pricing pressure above,

$$UPP_1 = D_{12}(P_2 - c_2) = \frac{s}{1+s(n-2)}(p_2^* - c_2).$$

If we assume three firms ($n = 3$), simplify to the case of common marginal cost c, and fix the parameter $a = 1$, then

$$p_i^* - c = \frac{1}{2}(1-s)(1-c)$$

and

$$UPP_1 = \frac{s(1-s)}{2(1+s)}(1-c).$$

Given these parameters, it follows that for $s = 1$ and for $s = 0$, $UPP_1 = 0$, but for $s \in (0,1)$, UPP_1 is positive.

Thus, for independent firms, upward pricing pressure would indicate no concern associated with the merger, and for perfect substitutes, upward pricing pressure would indicate no concern associated with the merger, but for different reasons. With independent products, pricing decisions are not affects by the merger, so there is no concern. With perfect substitutes, competition between the merged entity and the remaining independent third firm is assumed to be sufficient to keep prices at the level of marginal cost, so again there is no concern. For a given level of substitutability, upward pricing pressure is greater when marginal costs are lower.

2.3 Industry with multi-product firms

In this section, we develop and example to illustrate both a UPP calculation and also the quantification of coordinated effects using a differentiated products oligopoly model.

We consider a scenario with four firms. Firms 1 and 2 both produce two products. Firm 1 produces A_1 and B_1, and firm 2 produces A_2 and B_2. Firm 3 produces only product A_3, and firm 4 produces only product B_4. Assume that products A_1, A_2, and A_3 are close substitutes and that products B_1, B_2, and B_4 are close substitutes, but that the A products and B products are not close substitutes. Thus, firm 3's product competes closely with one of firm 1's products and one of firm 2's products. Firm 4's product also competes closely with one of firm 1's products and one of firm 2's products. But, the products of firms 3 and 4 do not compete closely with one another.

Consider a merger between firms 3 and 4. Because products A_3 and B_4 are not close substitutes for one another, there would be little upward pricing pressure as a result of the merger. Thus, upward pricing pressure would indicate little competitive concern associated with the merger.

To make the example concrete, assume that for distinct $i, j, k \in \{1, 2, 3\}$,

$$p_i^A = 1 - q_i^A - sq_j^A - sq_k^A - \sigma q_1^B - \sigma q_2^B - \sigma q_4^B$$

and for distinct $i, j, k \in \{1, 2, 4\}$,

$$p_i^B = 1 - q_i^B - sq_j^B - sq_k^B - \sigma q_1^A - \sigma q_2^A - \sigma q_3^A,$$

where $s, \sigma \in (0, 1)$, with s close to 1 and σ close to zero.

In this case,

$$D_{34} \equiv -\frac{\frac{\partial q_4^B}{\partial p_3^A}}{\frac{\partial q_3^A}{\partial p_3^A}} = \frac{(1-s)\sigma}{1+3s+2s^2-6\sigma^2},$$

which approaches zero as s approaches 1 or σ approaches zero. Thus, a merger of firms 3 and 4 generates little upward pricing pressure and so that criteria would indicate little concern associated with the merger.

However, when we compare the pre-merger and post-merger environments in light of possible coordinated effects, we see the potential for concern.

In order to present a numerical example, let $s = 0.9$ and $\sigma = 0.1$. Assume firms 1 and 2 have constant marginal costs equal to zero, and assume firms 3 and 4 have constant marginal costs equal to 0.045.[4] Assume that a merger between firms 3 and 4 results in efficiencies that reduces their marginal costs to zero (the same as the incumbent multi-product firms).

With these parameters, we can calculate the pre-merger profits of the four firms under a variety of scenarios regarding coordination among the firms. Table 1 considers three scenarios for coordination. In the pre-merger environment with coordination by firms 1 and 2, firms 1 and 2 coordinate their pricing decisions to maximize their joint profit, while firms 3 and 4 choose the price of their individual products to maximize their individual profits. In the pre-merger environment with coordination by firms 1, 2, and 3, firms 1–3 coordinate their pricing decisions to maximize their joint profit, and similarly for the pre-merger environment with coordination by firms 1, 2, and 4. As shown in Table 1, firms 1 and 2 increase their profits through coordination, but firms 3 and 4 would prefer to remain outside the cartel of firms 1 and 2 rather than join them. The two smaller firms prefer to remain outside the cartel where their prices are not constrained by the joint profit maximization problem of the larger firms.

Table 1: Pre-merger profits

	Profit 1	Profit 2	Profit 3	Profit 4
pre-merger	0.039	0.039	0.005	0.005
pre-merger: coordination by 1 and 2	0.051	0.051	0.012	0.012
pre-merger: coordination by 1, 2, and 3	0.134	0.134	0.004	0.014
pre-merger: coordination by 1, 2, and 4	0.134	0.134	0.014	0.004

Table 1 suggests that although there is an incentive in the pre-merger market for coordination between firms 1 and 2, in the absence of significant compensating transfer payments, there is no incentive for firm 3 or firm 4 to join the cartel.

That characterization changes for the post-merger market. As shown in Table 2, in the post-merger industry, the merged entity 3-4 does have the incentive to join firms 1 and 2 in the coordination of prices.

Table 2: Post-merger profits

	Profit 1	Profit 2	Profit 3-4
post-merger: coordination by 1 and 2	0.037	0.037	0.046
post-merger: coordination by all	0.161	0.161	0.161

[4] This marginal cost is sufficiently small that an all-inclusive cartel prefers to continue to allow firms 3 and 4 to produce positive output.

The comparison of the pre-merger and post-merger profits shows that the merger increases the incentive for the merging firms to participate in coordinated pricing in the industry.

Thus, even though upward pricing pressure does not signal a competitive concern associated with the merger, there are potentially significant coordinated effects concerns.

2.4 Application to vitamins

This analysis above can be applied to the firms involved in the Vitamins Cartel.[5]

Consider a merger of vitamins manufacturers Rhone-Poulenc and Takeda. During the period of the vitamins conspiracy, Rhone-Poulenc manufactured vitamins A, E, and D3, while Takeda manufactured vitamins B1, B2, B6, C, and Folic acid.[6]

Because of the lack of direct overlap, an analysis of upward pricing pressure would not signal any potential concern associated with the merger. However, the merger would create a firm capable of producing eight of the 12 vitamin products considered in the EC Decision in *Vitamins*, making the merged entity a key competitor to the two largest players in the cartel, Roche and BASF.

Table 3: Vitamin Products for Key Vitamins Cartel Participants

	A	E	B1	B2	B5	B6	Folid Acid	C	D3	H	Beta carotene	Caro - tinoids
Roche	X	X	X	X	X	X	X	X	X	X	X	X
BASF	X	X	X	X	X			X	X	X	X	X
Rhône-Poulenc	X	X							X			
Takeda			X	X		X	X	X				
Merged RP-Takeda	X	X	X	X		X	X	X	X			

Source: EC Decision in Vitamins at paragraph 2

As in the model discussed above, one might expect the merger of Rhone-Poulenc and Takeda to result in significant coordinated effects concerns.

In contrast, the merger of Rhone-Poulenc with a firm such as Solvay, which produces only Vitamin D3, or with a firm such as Eisai, which produces only Vitamin E, would result in upward pricing pressure and so potentially receive attention based on the merger screen of upward pricing pressure. As another example, a merger of minor players, such as Kongo and Sumika, both of which produce only Folic Acid might be identified as a cause for concern based on upward pricing pressure.

[5] See the EC Decision in *Vitamins*, available at http://eur-lex.europa.eu/LexUriServ/site/en/oj/2003/l_006/l_00620030110en00010089.pdf (accessed December 10, 2010).

[6] EC Decision in *Vitamins* at paragraph 2.

As this suggests, in some cases UPP does not provide a useful screen to identify mergers of antitrust concern because it allows mergers to go through that involve significant coordinated effects.

3 Coordinated effects in a procurement model

In this section, we approach the analysis of coordinated effect by modeling the interaction among competing suppliers at competitive procurements. Such a model is appropriate in cases where buyers conduct competitive procurements to acquire the products of the merging firms. In Section 3.1, we introduce our application involving the recent BASF-Ciba merger. In Section 3.2, we show a quantification of the basic incentives for coordinated effects in the merger. In Section 3.3, we analyze the effects of cost efficiencies, showing how they enhance the incentives for coordinated effects in this application. In Section 3.4, we show how certain behavior might be interpreted as that of a maverick firm. In Section 3.5, we analyze the effects of divestiture on incentives for coordinated effects, showing how certain divestitures can reduce those incentives. In Section 3.6, we briefly summarize.

Unfortunately, sealed-bid procurements (auctions) are not trivial to analyze.[7] The differential equations and boundary conditions that define the unique Nash equilibrium are almost always analytically intractable. Numerical methods are required to solve them. But, under somewhat mild conditions, the solution is unique. This is a positive attribute when considering the use of the framework for policy analysis because we avoid the ambiguities created by multiple equilibria as we move from one industry configuration to another. A recent breakthrough in the economics literature by Gayle and Richard (2008) permits the type of analysis required to quantify the effects of bidder collusion at procurements and so to study coordinated effects.[8]

In addition to affecting the behavior of colluding bidders, collusion at a sealed-bid procurement affects the bidding behavior and expected payoff of non-colluding bidders.[9] The

[7] By a sealed-bid procurement (auction), we mean that bidders simultaneously submit sealed bids – the low (high) bidder wins and receives (pays) the amount of their bid. For more complicated procurements where bids are multi-dimensional, each bid is "scored" (i.e. mapped into a real number), ranked, and the winner is the firm with the best score. The winning bidder delivers per their bid and receives payment from the procurer per their bid.

[8] Gayle and Richard (2008) provide numerical methods, together with an analytical result for evaluating Taylor Series expansions of inverse functions, that allow the use of any underlying distribution for values or costs, even empirical ones. Prior to this work, one was constrained to work with power functions and extreme value distributions, neither of which may have adequate flexibility to account for the richness of a given merger environment.

[9] This is not the case for descending-bid procurements. See, e.g., Robinson (1985) and Marshall and Marx (2006).

benefits from the suppression of competition between the merged entities typically cannot be captured exclusively by the merging firms. Some of the suppression of rivalry benefits non-merging firms as well.[10]

A single object auction/procurement analysis does not capture a reduction in quantity as a consequence of coordinated effects. Additionally, our analysis quantifies payoffs to fully explicit collusion as opposed to some lesser forms of coordination. These two aspects of the proposed analysis should be kept in mind when it is used to quantify coordinated effects.

3.1 Application to BASF-Ciba

We discuss procurement-based techniques for quantifying coordinated effects within the context of an example based on the 2009 merger of chemical manufacturers, BASF and Ciba Holding Inc. Under the terms of a consent order allowing the transaction to proceed, the FTC required BASF to sell all assets related to the two pigments, bismuth vanadate and indanthrone blue, but both BASF and Ciba produce a variety of other chemicals in common.[11] We focus on one in particular, the chemical Dimethylaminoethyl acrylate (DMA3) that is an intermediate in the production of chemicals used in the water treatment and paper industries, or as a specialty monomer.[12]

We view the manufacturers of DMA3 as competing with one another through their bidding at competitive procurements used by buyers to purchase DMA3. We model the market as involving manufacturers BASF, Ciba, and Arkema, plus two fringe firms. We standardize firms' costs on the zero to one interval and model them as draws from individually calibrated Beta distributions.[13] Computations are done using the numerical algorithm of Gayle and Richard (2008).[14]

[10] Duso, Gugler, and Yurtoglu (2007) examine the abnormal returns of non-merging firms around the announcement of a merger and other events related to antitrust enforcement for evidence of anti-competitive effects.

[11] FTC Press Release, April 2, 2009, "FTC Intervenes in BASF's Proposed $5.1 Billion Acquisition of Ciba Holding Inc.," available at http://www.ftc.gov/opa/2009/04/basf.shtm, accessed December 18, 2010.

[12] Case No COMP/M.5355 - BASF/ CIBA, Notification of 22 January 2009 pursuant to Article 4 of Council Regulation No 139/20041, pp.2–3, available at http://ec.europa.eu/competition/mergers/cases/decisions/m5355_20090312_20212_en.pdf accessed December 17, 2010.

[13] In the baseline model, Ciba and the two fringe firms are modeled as having costs drawn from the Beta distribution with parameters $(5.0, 1, 0)$. BASF is modeled using a Beta distribution with parameters $(2.8, 2.0)$, and Arkema is modeled using a Beta distribution with parameters $(1.0, 2.5)$.

[14] We modify the algorithm of Gayle and Richard (2008) to allow the exponents used to construct coalitions to be real numbers.

3.2 Incremental incentives for coordination

Given the market shares for DMA3, we can calibrate a procurement model to replicate the market shares of the firms. We use the market share ranges for DMA3 given on p.4 of the EC Decision in the merger of BASF/Ciba as a guide in calibrating the cost distributions for the DMA3 producers.[15] We view potential collusion between the dominant firm in the market, Arkema, and BASF as something of possible concern given the history of collusion between those two firms. For example, both Arkema and BASF were involved in cartels in tin stabilizers and in ESBO/esters. These cartels were supported by a consultancy firm based in Switzerland, AC Treuhand, which organized and monitored various aspects of the collusive agreements.[16]

The target market shares are those shown in Table 4 in the panel for pre-merger non-cooperative. Given cost distributions generating these pre-merger non-cooperative market shares, we can then calculate the shares associated with three other scenarios. In the pre-merger cooperative scenario, we model collusion between BASF and Arkema by assuming BASF and Arkema act as one bidder with a cost equal to the minimum of the cost draws for the two firms.[17] In the post-merger non-cooperative scenario, we model the merger of Ciba and BASF by assuming Ciba and BASF act as one bidder with a cost equal to the minimum of the cost draws for the two firms. In the post-merger cooperative scenario, we model collusion between the merged firm Ciba-BASF and Arkema by assuming Ciba, BASF, and Arkema act as one bidder with a cost equal to the minimum of the cost draws for the three firms.

[15] Case No COMP/M.5355 - BASF/ CIBA, Notification of 22 January 2009 pursuant to Article 4 of Council Regulation No 139/20041, p.4, available at http://ec.europa.eu/competition/mergers/cases/decisions/m5355_20090312_20212_en.pdf, accessed December 17, 2010.

[16] Patricie Eliasova, Josefine Henderstrom, Willibrord Janssen, and Eline Post, "The heat stabilisers cartel," *Competition Policy Newsletter* 1, 51–52, 2010, available at http://ec.europa.eu/competition/publications/cpn/2010_1_16.pdf, accessed December 17, 2010.

[17] Formally, if firms A and B draw their costs from distributions F_A and F_B, then we model the cartel of A and B and the merged firm A-B both as drawing its cost from the distribution $1-(1-F_A)(1-F_B)$.

Table 4: Market shares in the baseline model

pre-merger non-cooperative			pre-merger cooperative	
Fringe 1	0.025		Fringe 1	0.066
Fringe 2	0.025		Fringe 2	0.066
Ciba	0.025		Ciba	0.066
BASF	0.265		BASF-Arkema	0.807
Arkema	0.666			
post-merger non-cooperative			post-merger cooperative	
Fringe 1	0.026		Fringe 1	0.090
Fringe 2	0.026		Fringe 2	0.090
Ciba-BASF	0.285		Ciba-BASF-Arkema	0.826
Arkema	0.669			

Using the cost distributions calibrated to pre-merger non-cooperative market shares, we can calculate the expected surplus to the bidding firms in the various scenarios. As shown by a comparison of the pre-merger non-cooperative panel and the pre-merger cooperative panel in Table 5, prior to the merger, BASF and Arkema can increase their joint profit by 30% (from 0.255 to 0.331) through cooperative behavior. Comparing the two post-merger panels, Table 5 shows that after the merger, Ciba-BASF and Arkema can increase their joint profit by 40% (from 0.261 to 0.366) through cooperative behavior. Thus, the merger increases the gains to BASF and Arkema from cooperative behavior, although the extent of this effect was not sufficient for there to be a required divestiture in DMA3 as a condition of merger approval by the U.S. Federal Trade Commission.[18]

Table 5: Expected surplus in the baseline model

pre-merger non-cooperative			pre-merger cooperative	
Fringe 1	0.002		Fringe 1	0.007
Fringe 2	0.002		Fringe 2	0.007
Ciba	0.002		Ciba	0.007
BASF	0.042		BASF-Arkema	0.331
Arkema	0.213			
post-merger non-cooperative			post-merger cooperative	
Fringe 1	0.002		Fringe 1	0.010
Fringe 2	0.002		Fringe 2	0.010
Ciba-BASF	0.045		Ciba-BASF-Arkema	0.366
Arkema	0.216			

[18]Decision and Order In the Matter of BASF SE, a Corporation, Docket No. C-4253, available at http://www.ftc.gov/os/caselist/0810265/090526basfdo.pdf, accessed December 17, 2010.

As a hypothetical example, and to provide contrast, consider a modification to the baseline model where we increase the share for Ciba and lower the share for Arkema. By increasing Ciba's share, we make the merger between BASF and Ciba a more significant undertaking.

In this case, we adjust the cost distributions so that the pre-merger non-cooperative shares are as shown in Table 6.

Table 6: Market shares in the adjusted model

pre-merger non-cooperative	
Fringe 1	0.026
Fringe 2	0.026
Ciba	0.215
BASF	0.265
Arkema	0.473

With these cost distributions, expected surpluses are as shown in Table 7.

Table 7: Expected surplus in the adjusted model

pre-merger non-cooperative			pre-merger cooperative	
Fringe 1	0.003		Fringe 1	0.004
Fringe 2	0.003		Fringe 2	0.004
Ciba	0.032		Ciba	0.046
BASF	0.043		BASF-Arkema	0.170
Arkema	0.104			
post-merger non-cooperative			**post-merger cooperative**	
Fringe 1	0.003		Fringe 1	0.012
Fringe 2	0.003		Fringe 2	0.012
Ciba-BASF	0.081		Ciba-BASF-Arkema	0.292
Arkema	0.116			

As shown in Table 7, prior to the merger, BASF and Arkema can increase their joint profit by 16% (from 0.147 to 0.170) through cooperative behavior. After the merger, Ciba-BASF and Arkema can increase their joint profit by 48% (from 0.197 to 0.292) through cooperative behavior. Thus, in this case the merger has a more substantial effect on the incremental incentives for cooperative behavior.

As illustrated by this example, when the merger combines two relatively equal firms to produce a new firm that is close to equal to the largest firm in the market, the gains for post-merger cooperative behavior can be substantially larger than the gains from pre-merger cooperative behavior.

3.3 Cost efficiencies

Returning to the baseline model, we now consider the potential for cost efficiencies as a result of the merger. Efficiency gains from the merger are modeled by adjusting the parameters governing the cost distributions of Ciba and BASF so that their respective mean costs are scaled down, with little change to their variances.[19]

We start by assuming 10% cost efficiencies. The associated expected surpluses are shown in Table 8.

Table 8: Expected surplus with 10% cost efficiencies

post-merger non-cooperative		post-merger cooperative	
Fringe 1	0.002	Fringe 1	0.009
Fringe 2	0.002	Fringe 2	0.009
Ciba-BASF	0.055	Ciba-BASF-Arkema	0.372
Arkema	0.188		

Recall that prior to the merger, BASF and Arkema can increase their joint profit by 30% (from 0.255 to 0.331) through cooperative behavior. After the merger, if we consider 10% cost efficiencies, Ciba-BASF and Arkema can increase their joint profit by 53% (from 0.243 to 0.372) through cooperative behavior. Thus, the presence of cost efficiencies increases the incremental gain from cooperative behavior.

The next table, Table 9, considers even greater cost efficiencies of 25%.

Table 9: Expected surplus with 25% cost efficiencies

post-merger non-cooperative		post-merger cooperative	
Fringe 1	0.001	Fringe 1	0.009
Fringe 2	0.001	Fringe 2	0.009
Ciba-BASF	0.071	Ciba-BASF-Arkema	0.386
Arkema	0.150		

After the merger, if we consider 25% cost efficiencies, Ciba-BASF and Arkema can increase their joint profit by 75% (from 0.221 to 0.386) through cooperative behavior.

These example illustrate that while cost efficiencies may relieve concerns regarding unilateral effects, they can exacerbate concerns regarding coordinated effects be making the merged entity a more valuable partner in a collusive arrangement for existing firms.

[19] In particular, let α_0 and β_0 be the baseline parameters for Ciba. Then, to model δ% efficiency gains, we use $\alpha_1 = \frac{\delta}{100}\alpha_0$ and $\alpha_1 + \beta_1 = \alpha_0 + \beta_0$. Using this rule to obtain 10% efficiency gains, the new parameters for Ciba are $(4.5, 1.5)$ and for BASF are $(2.52, 2.28)$. To obtain 25% efficiency gains, the new parameters for Ciba are $(3.75, 2.25)$ and for BASF are $(2.1, 2.7)$.

3.4 Maverick behavior

In this example, we reduce the pre-merger non-cooperative shares of Fringe 1, Fringe 2, and Ciba to 0.01, and correspondingly increase the shares of BASF and Arkema, as shown in Table 10. We refer to this model as the maverick model because it will allow us to interpret certain behavior as that of a maverick.

Table 10: Market shares in the maverick model

pre-merger non-cooperative	
Fringe 1	0.010
Fringe 2	0.010
Ciba	0.010
BASF	0.284
Arkema	0.690

In this model, the expected surpluses are as shown in Table 11.

Table 11: Expected surplus in the maverick model

pre-merger non-cooperative		pre-merger cooperative	
Fringe 1	0.001	Fringe 1	0.004
Fringe 2	0.001	Fringe 2	0.004
Ciba	0.001	Ciba	0.004
BASF	0.046	BASF-Arkema	0.392
Arkema	0.229		
post-merger non-cooperative		post-merger cooperative	
Fringe 1	0.009	Fringe 1	0.006
Fringe 2	0.009	Fringe 2	0.006
Ciba-BASF	0.047	Ciba-BASF-Arkema	0.423
Arkema	0.231		

As shown in Table 11, if BASF and Arkema collude and Ciba remains outside the cartel, Ciba's payoff is 0.004. If Ciba joints the cartel of BASF and Arkema, the joint payoff of the three firms is 0.423. If this is divided according to the firms' relative non-cooperative market shares, Ciba's payoff would be 0.004. Thus, prior to the merger, Ciba has little incentive to join a cartel of BASF and Arkema. One might interpret an unwillingness by Ciba to behave cooperatively with BASF and Arkema as Ciba being a maverick.

Following the merger, once Ciba is joined with BASF, there is no impediment to cooperative behavior by Ciba-BASF and Arkema. There is a sense in which the merger's elimination of a maverick opens the door for cooperation among three firms, when only two might have coordinated prior to the merger.

3.5 Divestiture

Sometimes the FTC will approve a merger subject to the merging firms divesting certain assets or divisions. Our techniques can allow one to assess the extent to which such divestitures diminish unilateral and/or coordinated effects.

Consider the case in which Fringe 2 is initially part of Ciba so that the pre-merger non-cooperative market shares are as shown in Table 12.

Table 12: Market shares in divestiture model

pre-merger non-cooperative	
Fringe 1	0.025
Ciba	0.052
BASF	0.265
Arkema	0.662

In this case, as shown in Table 13, prior to the merger, BASF and Arkema can increase their joint profit by 34% (from 0.255 to 0.341) through cooperative behavior. After the merger, Ciba-BASF and Arkema can increase their joint profit by 60% (from 0.269 to 0.431) through cooperative behavior.

Table 13: Expected surplus in divestiture model

pre-merger non-cooperative			pre-merger cooperative	
Fringe 1	0.002		Fringe 1	0.008
Ciba	0.006		Ciba	0.016
BASF	0.042		BASF-Arkema	0.341
Arkema	0.213			
post-merger non-cooperative			post-merger cooperative	
Fringe 1	0.003		Fringe 1	0.018
Ciba-BASF	0.050		Ciba-BASF-Arkema	0.431
Arkema	0.219			

Suppose competition authorities requiring Ciba to divest the assets of Fringe 2. In this case, the post-merger incentive for cooperative behavior falls to 40% as shown in Table 5 above, which is not dramatically more than the pre-merger incentive for cooperative behavior. In this sense, divestiture can address incentives for coordinated behavior.

As an alternative way to think about possible divestiture, suppose that Ciba consists of two groups of assets and that competition authorities only allow the merger of BASF with one of the groups of Ciba assets. Specifically, suppose that the pre and post-merger non-cooperative market shares are as shown in Table 14.

Table 14: Market shares in alternative divestiture model

pre-merger non-cooperative	
Fringe 1	0.025
Fringe 2	0.025
Ciba	0.025
BASF	0.265
Arkema	0.666
post-merger non-cooperative	
Fringe 1	0.025
Fringe 2	0.025
Ciba-A	0.012
Ciba-B-BASF	0.275
Arkema	0.667

In this alternative divestiture model, expected surpluses are as shown in Table 15.

Table 15: Expected surpluses in the alternative divestiture model

post-merger non-cooperative			post-merger cooperative	
Fringe 1	0.002		Fringe 1	0.008
Fringe 2	0.002		Fringe 2	0.008
Ciba-A	0.001		Ciba-A	0.004
Ciba-B-BASF	0.043		Ciba-B-BASF-Arkema	0.347
Arkema	0.214			

As shown in Table 15, in the alternative divestiture model, the post-merger incentive for cooperative behavior falls to 35% (from 0.257 to 0.347), which is even closer to the pre-merger incentive for cooperative behavior. Thus, allowing a merger to incorporate only a subset of the target firm's assets can reduce incentives for post-merger coordinated effects.

3.6 Summary

In this section, we show that procurement processes can be modeled to allow quantification of the incremental payoffs for coordinated effects as the result of a merger. We show that cost efficiencies, while potentially reducing unilateral effects, can significantly increase the payoffs associated with coordinated effects. The behavior of a maverick firm can potentially be understood within the context of our model as arising from a superior payoff to non-participation; however, a merger can change this payoff, eliminating the incentive for maverick behavior. Finally, we show that our approach can be used to analyze the efficacy of various proposed divestitures in reducing incentives for coordinated effects.

4 Conclusion

We show that the incremental incentives for coordination created by a merger can be quantified using a standard model of oligopoly or a standard procurement model. We also show that, in some cases, UPP does not provide a useful screen to identify mergers of antitrust concern because it fails to flag mergers with significant coordinated effects. In addition, we show in our procurement model that cost efficiencies sufficient to allow the merger to pass an antitrust screen based on UPP, can exacerbate the incentives for coordinated effects. Thus, even the presence of significant cost efficiencies associated with a merger cannot be used by antitrust authorities as a reason to allow the merger without further coordinated effects scrutiny.

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